ASHESI UNIVERSITY COLLEGE

A TOOL FOR THE TEACHERS AND COACHES OF THE MOTHER TONGUE LITERACY PROJECT

APPLIED PROJECT

B.Sc. Management Information Systems

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A Tool for the Teachers and Coaches of the Mother Tongue Literacy Project

APPLIED PROJECT

Applied Project submitted to the Department of Computer Science, Ashesi University College in partial fulfilment of the requirements for the award of Bachelor of Science degree in Management Information Systems

Maame Yaa Afriyie Poku

April 2017

Declaration

I hereby declare that this Applied Project is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:

……

Candidate's Name:

……

Date: ……

I hereby declare that preparation and presentation of this Applied Project were supervised in accordance with the guidelines on supervision of Applied Project laid down by Ashesi University College.

Supervisor's Signature:

……

Supervisor's Name:

……

Date: ……

Acknowledgment

I would like to express my gratitude to my supervisor, Dr Ayokor Korasah for her support, dedication and guidance through the course of this project. I would like to thank my family and friends for their help and encouragement as I undertook this project and also Mr Addi, for his invaluable contribution to this project.

Abstract

There have been many changes in Ghana's school language policy and this is main due to the desire to improve literacy acquisition. However, there has been little improvement in the literacy and numeracy skills of students. There is now a recognised need for a better means of effectively teaching children, especially when it comes to English. The Mother Tongue Literacy Project was established to enhance mother tongue literacy acquisition and teach English as a second language.

This project aims at developing a technological tool that will support the teachers and coaches of the organisation. The application is tailored for the literacy project, and as such, it includes the lesson guides for the teachers and additional features such as a timer, an assessment form and a way to share and view photos of teaching and learning materials, to make it easy for them to prepare and teach each lesson.

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Chapter 1: Introduction

1.1. Introduction

Ghana has experienced many changes in its school language policy in the pursuit of improving literacy, specifically English literacy among students. However, the country has seen little improvement in the literacy and numeracy skills of students. There is now a recognised need for an alternative means of effectively teaching children, especially when it comes to the English language. In 2007, there was a reform of the educational system, and this included a policy that necessitates the use of a local language as a medium of instruction at the primary level. In light of this, the Mother Tongue Literacy Project was established to enhance mother tongue literacy acquisition and teach English as a second language.

As a contribution to the improvement of the Mother Tongue Language Literacy, this project aims at developing a technological tool that will support the teachers and coaches of the organisation. The application is tailored for the literacy project, and as such, it includes the lesson guides for the teachers and additional features to make it easy for them to prepare and teach each lesson.

1.2. Background

The language of education in multilingual societies such as Ghana has always been of keen concern to educators and education planners. The official language of Ghana is English hence it is appropriate for citizens to know how to speak it. This is because it is used as a means of communication in government and large-scale private businesses as well as professional occupations and the educational system (Akrofi, 2003). However, in 2010, it was recorded that, one-third of the population can neither read nor write and most of these people are concentrated in the rural areas (Ghana Statistical Service, 2013). This means that

a significant number of Ghanaians lack the basic reading and writing skills and this is alarming.

Many children in the rural areas of Ghana struggle with the ability to read in English. These children grow up speaking their first language, which is their mother tongue, and as they start school, they are expected to learn how to read and write in English. Unfortunately, Ghana's educational system before 2007 required that teachers use the English Language for content area instructions in the lower levels. This system did not seem to be effective enough since students were still struggling with the English language. A criterion-referenced test conducted nationwide in 2010 showed that less than 10% of students in class six were able to read fluently (Lipson & Wixson, 2004). Additionally, Early Grade Reading and Mathematical assessments were conducted nationwide in 2013 on 7,923 primary two students. The results showed that only 1.8% of the students could read fluently and understood what they were reading, 43.8% could read some words but did not understand, and 50.7% could not read at all (Ministry of Education, 2013).

Studies have shown that an effective way for a non-English speaking individual to learn how to how to read and speak English is being instructed in their native language (Burns, Griffin, & Snow, 2014). Thus, it is advisable to instruct students in a language they already understand to help them grasp the English language easily. In 2016, a study conducted in Zambia showed a positive impact when a local language was used as a medium of instruction at the primary school level (Banda, & Kabubi, 2016).. The students that undertook this study did not only perform better academically but had a high level of concentration, and they were easy to teach (Banda, & Kabubi, 2016). Additionally, it was discovered that children learn to read and write better and quickly in their mother-tongue, and can then transfer these skills to a second language (Ministry of Education, 2013).

1.3. Related Work

Many steps have been taken to help improve reading literacy in Ghana. Organisations and projects have been set up to tackle this problem. Some of these organisations and projects are:

1.3.1. The Olinga Foundation

The Olinga Foundation organises a nine-month literacy programme which is infused into the school curriculum at the upper primary level to give students who cannot read the opportunity to learn how to do so (“Olinga Foundation", 2014). Although the foundation sees the need for early grade literacy, it focuses on the upper primary level because there are a large number of students in this category that still do not know how to read.

Additionally, the Olinga foundation trains up to 75 teachers across 50 schools every year in deprived districts. It has specific training models and approaches which help shape the teachers into moral and responsible leaders who are well equipped to teach students effectively. Since its launch in the year 2000, the foundation has trained over 450 teachers, and over 20,000 students have undergone and benefited from the literacy programme (“Olinga Foundation", 2014).

1.3.2. World Reader

This organisation collects books of authors in Africa and India and stores them in their digital library. The library is accessible to readers in over 55 countries. The organisation has also established digital platforms to make their books available to people who need them. World Reader reading apps have been created by this organisation to allow access to the world readers digital library from anywhere in the world. Additionally, the organisation embarks on fieldwork in countries such as Ghana, Spain, India, United

Kingdom and New Delhi. They partner with the local governments on various education projects and support their school systems. (Worldreader, 2017).

1.3.3. National Literacy Acceleration Project

In June 2006, the National Literacy Acceleration Program (NALAP) was launched to help promote literacy and numeracy among lower primary pupils through the use of a local dialect. It was launched in support of the new policy that necessitated the use of local languages in the educational system. NALAP, as described by Leherr and Johnson (2009), is a bilingual transitional "early exit" model. In this program, children learn to read in their mother tongue (L1) and then move on to learn to speak English (L2) in a GES approved framework (Leherr & Johnson, 2009).

1.3.4. Project LISTEN

Many studies have been conducted to discover the best way to improve English literacy in children. An excellent example of such studies is Project Kane, which was a research project conducted in Ghana to explore the role of technology in the improving child literacy (Korsah et al., 2010). The main objective of this project was to find out how effective an automated tutor would be in the Ghanaian context. The reading tutor used was Project LISTEN (Literacy Innovation that Speech Technology Enables) automated tutor. This tutor, however, was modified to suit the Ghanaian setting. It displays some text on a screen and 'listens' as the user reads out loud. The tutor uses Carnegie Mellon's Sphinx speech recognizer to analyse the child's oral reading. The tutor also gives spoken and graphic assistance and records the progress of the user. The reading tutor can run on any personal computer that uses Windows operating system. Although it is not yet commercial, it is utilised in many field tests in the United States, Canada, Ghana and India.

In this project, the controlled study consisted of three groups of students from primary two to four of different schools. The first group (S1) consisted of students from a private school, the next group (S2) consisted of students from a public school and the last group (S3) comprised of children with no formal education. The experiment revealed that the S2 group gained more from using the tutor than the other groups. The S1 group seemed to be more acquainted with what the tutor offered. Although this tutor has proven to be successful with native English speakers, this experiment showed that the use of an automated reading tutor would also be helpful to children who are now learning English. A similar experiment was conducted in India, where students study English as a second language. In that particular study, the students portrayed a significant improvement in their fluency tests. (Weber & Bali, 2010).

1.3.8. The ZEdupad

The ZEdupad is a tablet used by students in Zambia. This device is loaded with lessons and materials for Zambia's primary school curriculum from grade 1 to 7 and can be used in eight local languages and English as well.

1.3.9. The Qelasy Table

In 2014, an entrepreneur developed educational tablets for students in Ivory Coast and Tunisia. Its main objective is to replace the use of heavy textbooks entirely. The tablets are water and dust resistant and come preloaded with educative applications. (Shezi, 2016).

1.4. The Mother Tongue Literacy Project

World Education Ghana devised a 17-month pilot program in June 2014 for ten schools in the Akuapem North District of Ghana. Its main objective was to enhance mother tongue literacy acquisition and to also improve English as a second language in primary one. Unlike the NALAP, the Mother Tongue Literacy Project (MTLP) places much emphasis on

teacher training, provides supplementary teaching and learning materials and includes coaching support to the teachers to foster improved student literacy outcomes. Through this project, the number of students who can read on their own has increased dramatically. Additionally, there has also been an improvement in class attendance as students are more excited to learn in a new way. Since the project was extremely successful, it has been extended and is currently being carried out in several schools in the district.

1.5. Problem Statement

After carrying out an informal observation at two of the primary school under the Mother Tongue Literacy Project, it was found that the teachers rely on two sets of bulky lesson guides to prepare for each lesson. The teachers also struggled to stay within the allotted time for each section of the lesson. Additionally, there were some issues with the pronunciation of certain words in the native language. These issues make it difficult to deliver the lesson as expected and could be a hindrance to the objectives and aims of the project.

1.6. Proposed System and its Benefits

The MTLP Application is aimed at providing the teachers and coaches with this support and convenience. Convenience in the sense that the teacher would not have to rely on just the bulky daily lesson plans provided for the program but instead, they could conveniently gain access to it on a tablet or a mobile phone. It will also provide support in terms of preparation for teaching and coaching other teachers. Thus, the main purpose of this project is to develop a technological tool to be used by the teachers in the Mother Tongue Literacy Project. This tool will have three different modes; the preparation mode, the teaching mode and the coaching mode. In the preparation mode, the teacher would have access to all the daily lesson plans for the course and can also get the right pronunciation of the various words and sounds for each lesson. The teaching mode will provide the teachers

with a timer for the lesson. The teacher can also upload pictures of the teaching and learning materials used. The coaching mode allows the user to assess a teacher and give recommendations.

1.7. Objectives

The main focus of this project is to enhance the Mother Tongue Literacy Project by providing the teachers and coaches with the necessary technological support. As such, the project objectives are:

- To provide a more interactive alternative to the already existing daily lesson guides.
- To make it preparation for teaching easier for both teachers and coaches.
- To make assessment more effective.

1.8. Outline of Report

There are six chapters in this report. The first chapter looks at the introduction and background of the project. It also covers the related work as well as the motivation, objectives, and benefits of the proposed solution. The second chapter covers the requirements of the application and the third chapter consists of the architecture and design of the project. Chapter four then looks at the implantation of the project and chapter five, the testing and its results. Finally, chapter six talks about the conclusion and recommendations.

Chapter 2: Requirements

This chapter gives a detailed description of the MTLP Application and its features as well as the functional and non-functional requirements. It explains how the requirements were obtained and describes the intended users of the application.

2.1. Requirements Gathering

The requirements needed for the application were gathered through informal observations and interviews conducted with the teachers and coaches.

2.1.1. Informal Observations

Two schools in Akropong were selected to carry out these observations. These schools were chosen because they were under the World Education's Mother Tongue Literacy Program. In each school, a primary one English class was observed. Through these observations, knowledge on how the literacy program is conducted was obtained. The first portion of the class which lasted for about sixty minutes was in Akuapem Twi and the second portion which was in English lasted for thirty minutes.

It was fascinating how enthusiastic and responsive the students were. They were keen to learn and engaged with each other when required. The teacher managed to keep the student's attention throughout both sections of the lesson and used the teaching and learning materials very efficiently. At the end of each lesson, there was an opportunity to talk to the teachers and discuss what went well and what could have gone better. For instance, during the debriefing sessions, it was realised that teachers who are not native speakers of Akuapem Twi sometimes had challenges with getting the right pronunciation of certain words in the language. Also, the teachers struggled to stay within the time allotted to the various sections of the lesson.

2.1.2. Interviews

Interviews were conducted with three teachers and three coaches to gain insight into the project and to find out the best way in which technology can improve it. This interview also led to the identification of the issues the teachers and the coaches face regarding preparation, delivering the lesson and assessment.

The teachers were asked to give details about how they prepare for each lesson and how long it takes to prepare. They were also asked to outline the problems they face when preparing for a lesson. The interview questions asked can be found in the Appendix (1).

From these interviews, it was discovered that the teacher had no audio support (CDs). Those who did not know the Akuapem Twi language had difficulties getting the right pronunciation. Additionally, the teacher also expressed their frustrations with regards to the preparations of teaching and learning materials

2.1.3. Daily Lesson Guides

The daily lesson guides for the MTLP were obtained for this project. These lesson guides are divided into two books; one for the English aspect and the other for the Akuapem Twi part of the programme. In the English daily lesson guide, a lesson has nine sections which are objectives, lesson preparation, vocabulary, revision, phonemic awareness, vocabulary, comprehension and communication and finally, looking ahead. Each of these sections has an allocated time

Lessons in the Akuapem Twi Lesson Guide, on the other hand, have objectives, lesson preparation, letters, consonant blends, sights words, revision, phonemic awareness, phonics, fluency, reading comprehension, writing, vocabulary and looking ahead. Similar to the English lesson guide, the Akuapem Twi lesson guide has time allocated to each section.

2.1.3. Teaching and Learning Materials

Each lesson is accompanied by teaching and learning materials (TLMs) which are prepared by the class teacher. From the interviews conducted it was discovered that teachers find it difficult to make these TLMs and usually rely on the help of other teachers and coaches to complete this task.

2.2. Scope of the Project

The MTLP Application is a mobile application, and it is designed to be compatible with numerous devices such Android, Windows or IOS Devices. It is loaded with the course materials which are the daily guide for the Akuapem Twi and English lessons which can be accessed offline. Additionally, it is equipped with an on-demand playback of the various letter sounds and words in the lessons. Another important feature of this application is the timer which will enable the teachers to stay within the allocated time for the various sections of the lesson. Teachers will be able to upload and view teaching and learning materials shared by other teachers. Finally, it has an assessment section, where coaches can enter their evaluations and remarks on the teachers' performance.

2.3. User Description

The main users of this system are the teachers and coaches of the Mother Tongue Literacy Project.

2.3.1: Teachers

They will use the application to prepare to teach the primary one classes. These teachers are people of different backgrounds and have been posted to teach at the schools that happen to be using the MTLP system.

2.3.2: Coaches

These are trained individuals whose primary aim is to assist the teachers as they teach and prepare for classes. The coaches also assess the teachers fortnightly and give them feedback on their performance.

2.4. User Requirements

The MTLP Application should provide the English and Akuapem Twi daily lesson guides, a way for coaches to assess the teachers and a way to view relevant teaching and learning materials.

2.5. System Requirements

System requirements are more detail descriptions of the application's functions and services. They define exactly what is to be implemented, and these are classified into functional and non-functional requirements.

2.5.1 Functional Requirements

The teachers who will be using this application should be able to do several fundamental tasks, and these include the following:

a. Login

The users should be able to login into the application. Logging in will help the teacher obtain the assessments done by the coaches, and give the coaches the permission to complete an evaluation for a teacher.

b. View the daily learning plans

The teachers will be able to view and select the lesson plans for each day to help them prepare for class. This application will be an alternative to using the physical copies, making it more convenient. After selecting the desired lesson, the users will be able to view the various sections of the lesson.

c. The system must be able to play the audio of the vocabulary and sight words

An additional function included in the daily lesson plans is the on-demand playback of the vocabulary and sight words for each lesson. This audio will aid the users to get the right pronunciations of the various words to be taught.

d. The user should be able to start the timer

The teachers should be able to access a specialised timer, which will guide them as they go about their lesson. This timer will beep to let the user know that the specified time has elapsed.

e. A coach should able to enter an evaluation of the teacher's lesson

A form should be provided to allow the coach to assess the teachers at the end of the lesson.

f. A teacher should be able to view the evaluation from the coach

Since the coaches are going to be entering evaluations for the teachers, the teachers must have a way to view them. These assessments will be under a tab in the profile page of the teachers

g. A teacher should be able to upload pictures of teaching and learning materials. Under the various lessons, the users will have the opportunity to upload pictures of the TLMs they used in delivering the lesson.

h. Teachers should be able to view photos of teaching and learning materials uploaded by other users as well as themselves.

2.6. Use Case for the Teachers

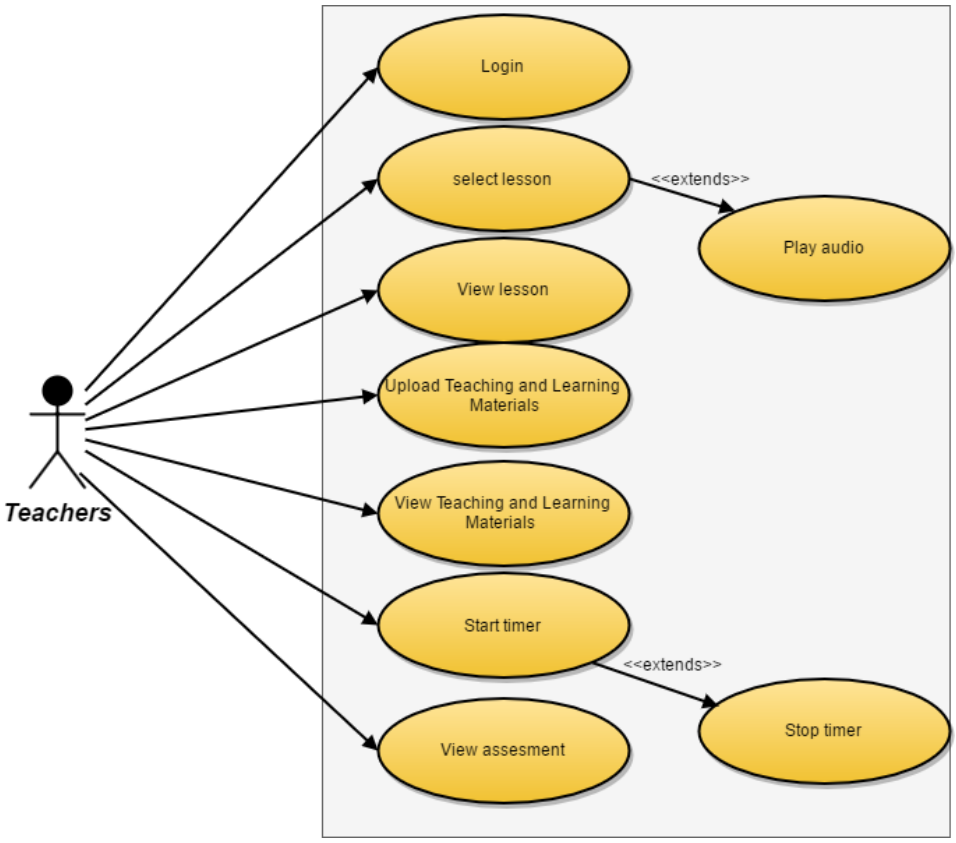

Figure 2.1 Use case diagram of the system for the teachers

2.6.1 Scenario

Jennifer, a primary teacher at St Joseph Anglican Basic School, needs to prepare to teach language literacy lesson to her primary one students. Jennifer has the MTLP application installed on her Samsung Galaxy phone, and so she quickly opens it and logs into the system. She selects the daily lessons tab that appears in the dashboard after she logs in and all the lessons are displayed. Since the students are currently in week 5 of the semester and the next day will be the second day of that week, she selects the Twi lesson for week 5, day 2. The first page of this lesson consists of the lesson objectives, the lesson preparation, the letters consonants and vowels and the sight words. Jennifer decides to play the audio for the various sight words of the lesson to get the pronunciations right so that she can teach the

students. She moves on to the next section of the lesson, which is the revision section and goes through the entire lesson in the same manner. The next day, Jennifer selects the timer on the application and finds the lesson she wants to time. She clicks the start timer button, and the timer starts counting down the minutes. However, she manages to finish before the timer runs out and so she stops the timer and goes back to the dashboard. Jennifer takes pictures of the teaching and learning materials used and uploads them using the MTLP application. She views the teaching and learning materials other teachers have uploaded for the upcoming lesson. After she is done, she logs out of the application and closes it.

Some general prerequisites for using the application are as follows:

- The user must have either a phone which runs on either Android or Windows.
- The user should have downloaded the application and installed it.

The main functionalities of the application are expanded below:

2.6.2. Login

a. Description

With this process, the user can gain access to the system and its functionality. It is also a way to enable the teachers to view to the assessment made for them by the coaches.

b. Prerequisite

- The user should be already registered in the system and as such must be part of the users in the database.

c. Flow

1. The user clicks on the application to open it and is presented with a splash screen after which the login screen appears.

2. The user enters his or her username and password and clicks login for his entry to be validated.
    - If the username is not found in the database's table of users, the user is prompted that there is an error with the username entered.
    - If the password does not correspond with that in the database for that username, the user will be asked to check the password entered and will be required to reenter the correct one.
    - If the username and password are validated, the user moves on to the next page.

d. Results

This process checks the database and retrieves the details of the user. It grants the teacher access to their assessments for the lessons. The coaches can also fill out an assessment form for the teachers after they complete a lesson.

2.6.3. Choose the daily lessons tab and view all the lessons

a. Description

This is the point when the user selects and opens the preferred lesson. The lesson consists of various sections, and once it is selected, the user can view each section one after the other.

b. Prerequisite

- The user should have logged into the system.

c. Flow

1. The user must select Lessons from the dashboard.
2. The lessons for each language are shown in their respective tabs.

3. The user picks the preferred lesson language and goes ahead to select the lesson based on the week and day.
4. The lesson is opened, and the user can click the next button to view the different sections of the lessons.
5. In the first section of the lesson, the user can play the vocabulary audio for English lessons and the sight word audio for the Akuapem Twi lesson.

d. Results

The selection made at the dashboard sends the user to the chosen destination. After which the user can continue with the activity he or she wants to carry out on the application. If the user selects the lessons, the lesson is fetched from the database and displayed.

2.6.4. Use the Timer

a. Description

This feature allows the user to stay within the allocated time for each section of the lesson. The timer notifies the user to switch to the next section of the lesson when the time for the previous section elapses.

b. Prerequisite

- The user should have logged in to the application
- The user should have selected a lesson

c. Flow

1. The user must first select a lesson and click the ‘start timer’ button.

2. When the timer starts, the user can decide to stop it, pause or move to the next section of the lesson.

e. Alternative Flow

The user can decide to view the lesson and can click ‘start timer’ in a section of the lesson, for instance in revision, to start the timer for that particular section.

d. Results

The timer starts and ends when the allocated time for the lesson elapses.

e. Alternative Results

- The user can decide to stop the timer and go back to the lesson page
- The user can skip to the next section of the lesson even before the timer is done.
- The user can decide to pause the timer and continue later.

2.6.5 Upload Teaching and Learning Materials

a. Description

Users can upload pictures of the teaching and learning materials used for teaching to share with others that may need assistance.

b. Prerequisite:

- The user should have logged in to the application.

c. Flow

1. The user opens the teaching and learning materials page.
2. The pictures are displayed.
3. The user can search and find the lesson need by entering a keyword or the week number and the day.

4. The user can also upload a picture by clicking the upload button.
5. When the upload button has been clicked, the upload screen appears, and the user enters the name of the picture, a description, and uploads the picture.
6. The user will be asked to verify the file to be uploaded and can either confirm or cancel.
7. After confirming, the user is given a confirmation message that the photo has been uploaded and is returned to the Teaching and Learning Materials page.
8. If the upload was cancelled the user is asked for a confirmation and upon receiving that confirmation, will be returned to the teaching and learning material page.

e. Results

A request is sent to the database to view all the pictures. A search runs a query to fetch particular items from the database. Uploading a picture adds to the table of existing TLMs

2.7. Use Case for the Coaches

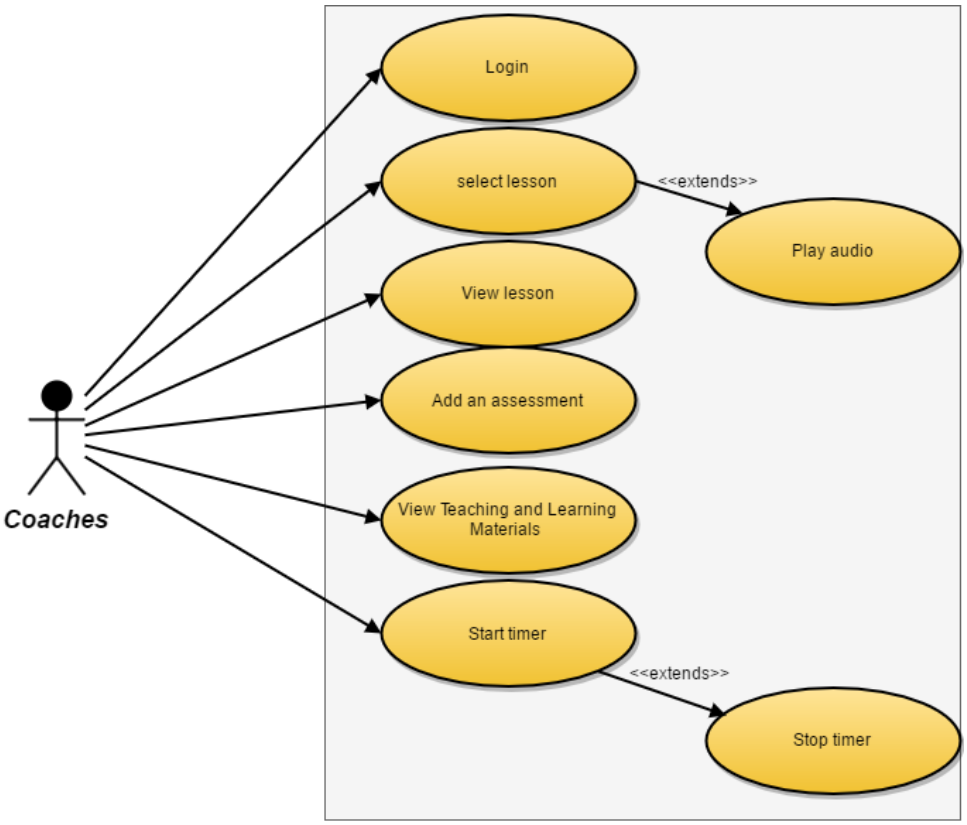

Figure 1.2: Use case diagram of the system for the coaches

2.7.1. Scenario

Kofi Manu, a coach at the Salem Basic School, needs to assess a teacher after a lesson. He logs into the MTLP Application and opens the assessment form. He selects his responses for the teaching regarding the English lesson and the Akuapem Twi half of the lesson as well. He submits the lesson and can quickly preview what he submitted.

2.7.2. Add an Assessment

a. Description

With this functionality, the user (coach) can assess another user (teacher).

b. Prerequisite

- The user should have logged in to the application

- The user should have selected a lesson and a teacher to assess

c. Flow

1. The user starts off by choosing the answers to the questions displayed in the assessment.
2. After entering the answers, the users can hit the submit button or cancels the assessment.

   -If the user selects the submit button, he or she must verify if they indeed want to submit the application.

   - If the user cancels the assessment, he or she has to confirm if he wants to cancel it or not. The page is redirected to the dashboard where the user can make another choice.

d. Results

The submission of the assessment form is an entry into the database after which user to which the assessment belongs to can view.

2.8. Non-Functional Requirements

2.8.1. Performance Requirements

The system must have a rapid response time. It must be able to give the user the necessary instructions information. It must also be fast in playing the audio to allow the user to prepare with ease. If the playback of the audio is slow, it will deter the users from using that functionality.

2.8.3. Compatibility Requirements

The application should be compatible with Android and Windows devices. The teachers and coaches have different devices, and therefore it is necessary to develop an application that can be used on multiple devices.

2.7.2. Availability

The system should always be available for use when needed. Its uptime should be at least 90% this is because the lessons are taught during the weekday, and it is necessary for the teachers to have access to it at all times to be able to prepare for teaching.

2.7.3. Interface Requirements.

The application should have a very user-friendly interface to encourage the teacher and coaches to use it. From the interview carried out, the user interface must also be easy to understand the available functions and use with ease. It should allow the user to navigate freely.

Chapter 3: Architecture and Design

3.1 System Architecture

The architecture for the application is a multi-layered architecture. This architecture improves maintainability and reuse. It also helps maximise separation of components. The layers comprise of the user experience layer, the business layer and the data layer. This architecture is illustrated in Figure 2 below:

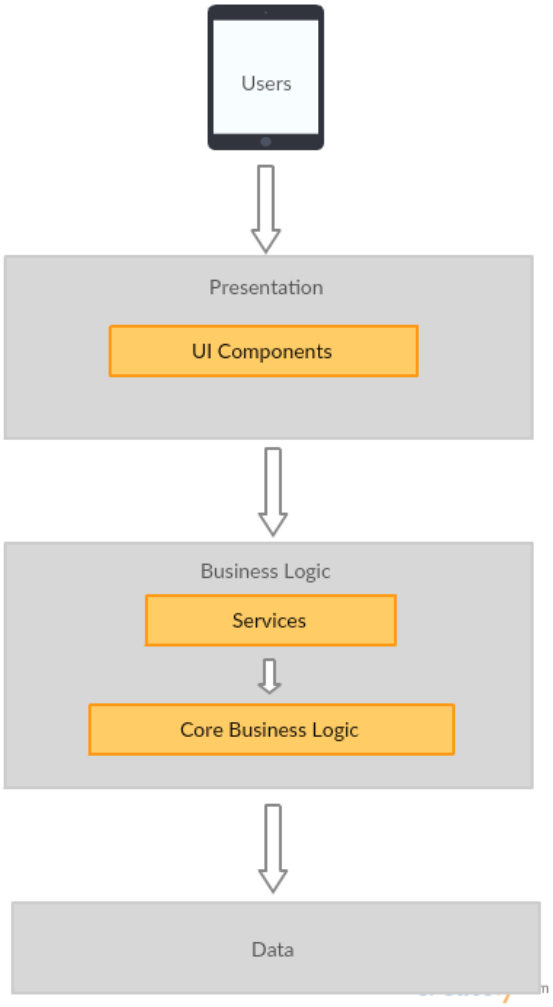

Figure 2.1: Architecture of the application

3.2. Model View Controller Architecture

The MTLP application is also built on a Model View Controller (MVC) architecture. This architecture divides the entire system into three main parts which are the model, view

and controller. This architecture is useful because it can provide multiple views and also, modifications made do not affect the entire model.

The model is where the data objects of the application are stored. It represents the logic and computations that process the data. The view displays the output it receives from the controller to the user. It receives this output by sending requests through the controller to the model. The controller represents the link between the view and the model. It provides the model with the necessary input through the views presented and converts the output so the user can easily comprehend.

3.2.1. The Model

The model for this application was built using MYSQL and later SQLite. The model is a database that consists of 24 normalised tables. Since each lesson has different sections, the database was built to cater for these sections. For instance, in the English lesson guide, each lesson has the following sections; Objectives, Vocabulary Words, Lesson Preparation, Revision, Phonemic Awareness, Vocabulary, Looking Ahead Comprehension and Communication. For each of these sections, a table was created to store the data on it. Additional tables were included to cater for the Akuapem Twi lessons, and these include Sight Words, Letters and Consonants (LBC), Phonics, Reading Comprehension Fluency and writing. In addition to these tables, other tables cater for the user's details and the audio files for the Akuapem Twi lesson. The figure below shows the entity relationship diagram of the database.

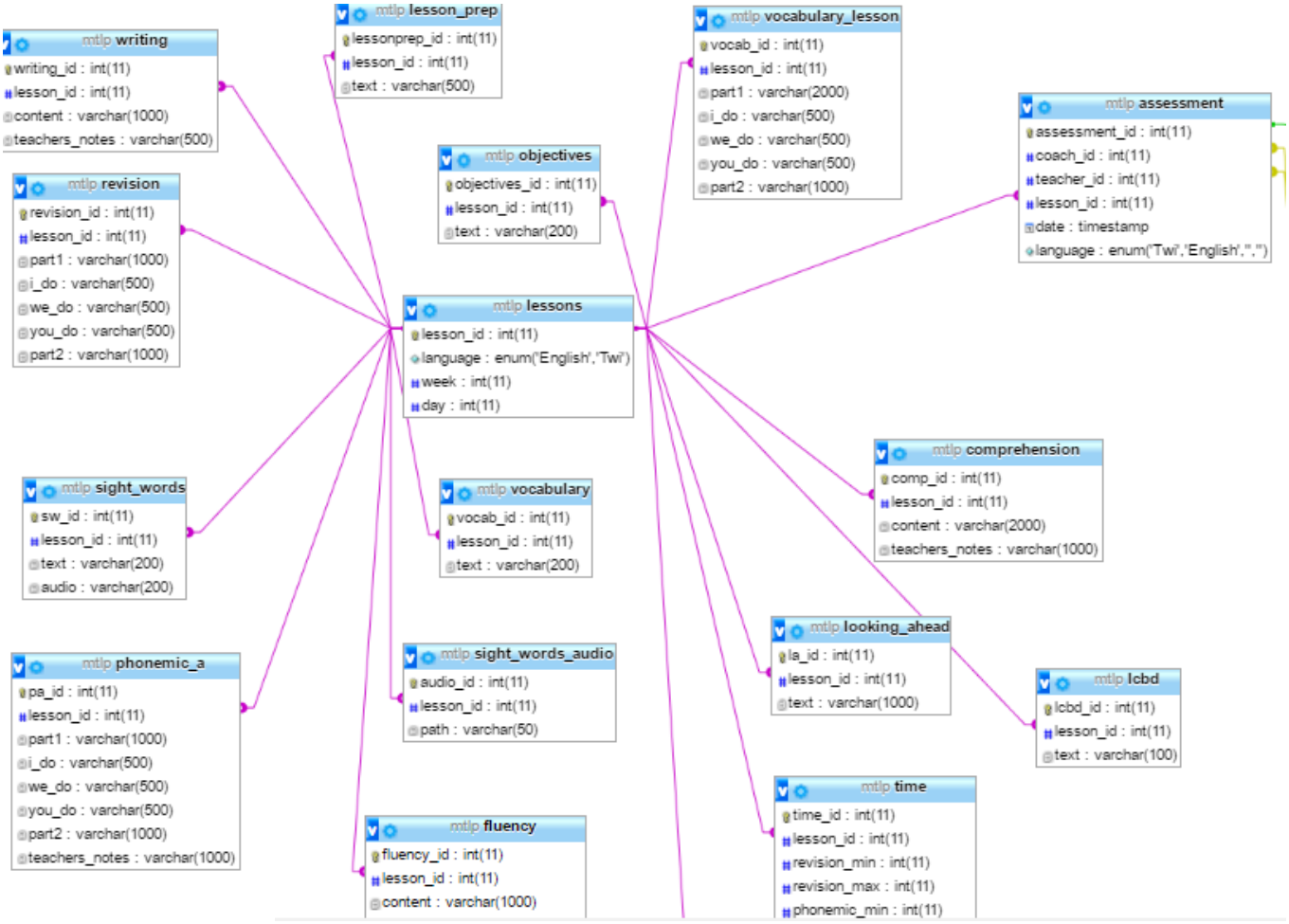

Figure 3.3: Database (a)

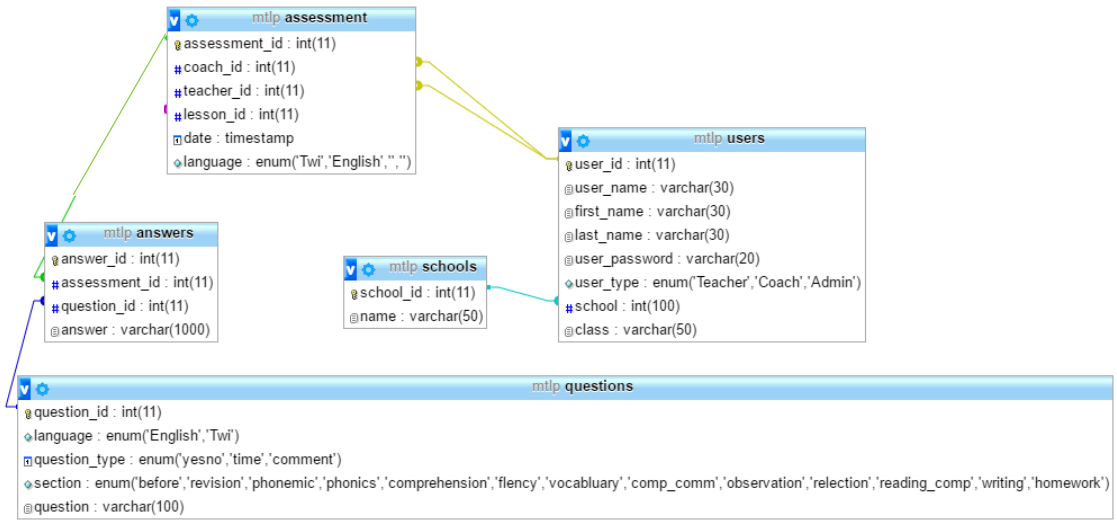

Figure 3.3. Database (b)

3.2.2. The View

In this project, the views are the Hypertext Markup Language (HTML) pages that the user sees. The main views of the application include the lessons view where the lesson is displayed, the assessment view, where the assessment form can be viewed and filled out and the teaching and learning materials display view, where the images of the TLMs are displayed.

3.2.2. The Controller

I n this application, the controller is built with Hypertext Preprocessor (PHP). It includes all the classes, as well as the Asynchronous JavaScript and XML (AJAX) functions used. The controller communicates with the database and sends responses to the view. The controller also obtains information from the view and sends it to the model. For instance, the assessment form view sends the responses to the controller, which sends it to the model, that is the database.

The controller uses several classes and these include:

- The users class: This controls the actions that can be performed on a user object
- The assessment class
- The lesson class

3.4. Process View

Below are activity diagrams showing show the various processes that will be carried out by the system:

3.4.1. Login

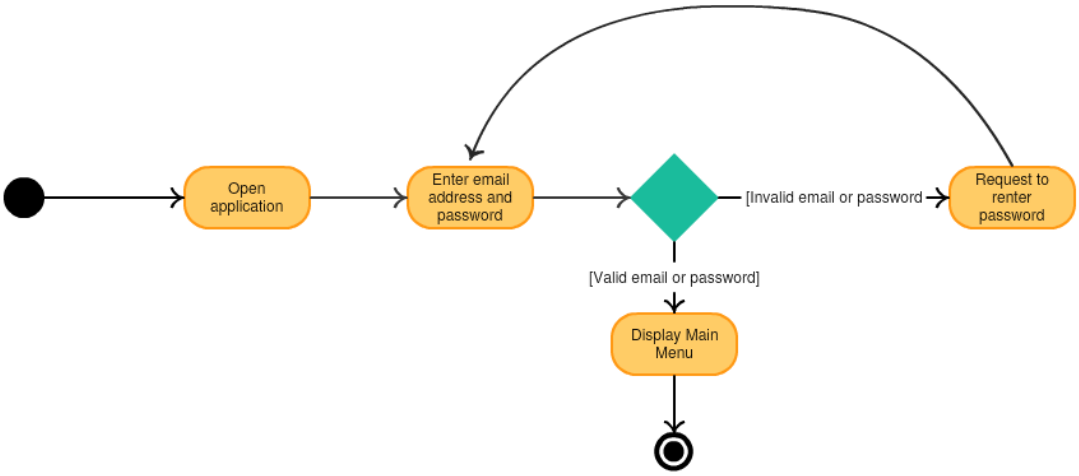

Figure 3.4: Login activity

The diagram above shows the design of the system when a user decides to log in. The user opens the application and enters a username and password. If the username and password are valid, the main menu will be displayed. If the email or password is invalid, the user will be requested to enter the user name and password and until it is valid it will not display the main menu.

3.4.2. Select option from the main menu

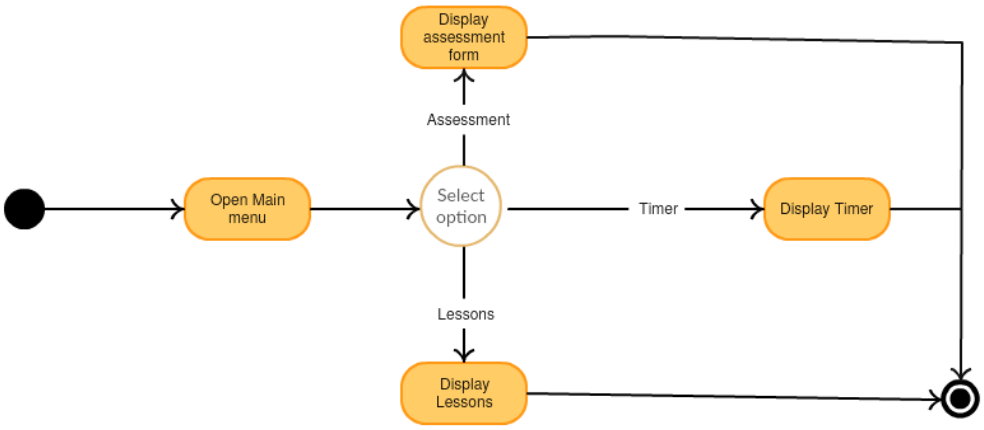

Figure 3.4: Selecting from the main menu

This shows the process a user goes through after logging into the system. At the main menu, the user can decide to view the lessons, assessment or timer.

3.4.3. View Lesson

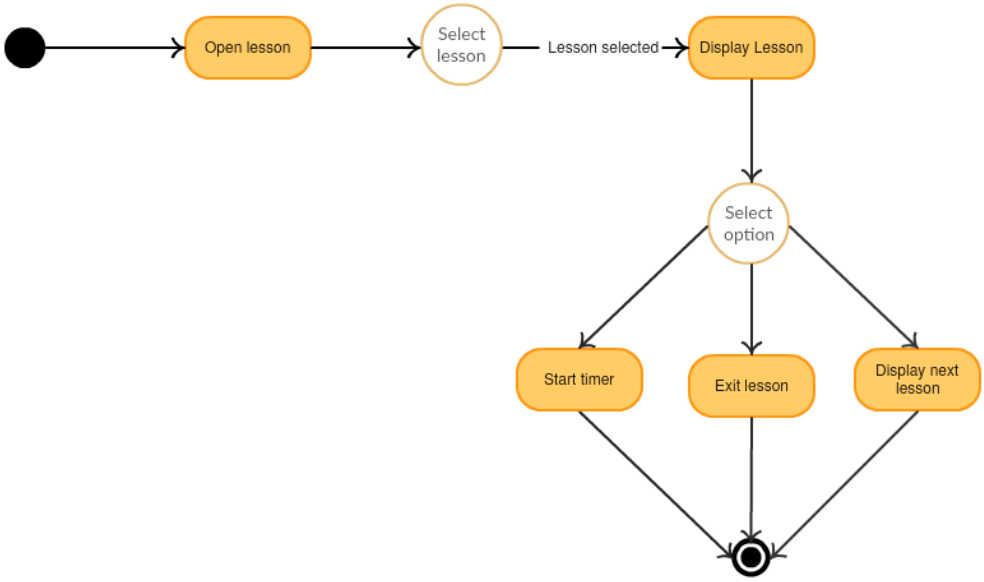

Figure 3.5: Viewing a lesson

This activity diagram depicts what happens when a user selects a lesson. Once the lesson has been selected, the user can decide to start the timer, start the timer or display the next lesson.

Chapter 4: Implementation

To implement this proposed application, many things were taken into consideration. This chapter highlights the consideration made for the implementation and the approach used. It also looks at the operational environment, resources used as well as the implementation of the various functional requirements.

4.1. Implementation Consideration

The first was the type of device it should be hosted on. Since the target users did not have immediate access to a personal computer, the best option was to provide them with an application which will be accessible on a mobile device. Another consideration made in relation to this was the type of mobile device used. Through the interview, it was found out that, most of the teachers would prefer the application to be on their phones. However, they used various kinds of phones. As such, it will be better if the application is a multi-platform one, to allow users with different types of phone to get access to it.

Another consideration was with regard to the data to be stored. As stated before, the Mother Tongue Literacy Project has two bulky lesson guides for the languages being taught. These lesson guides are filled with the lesson per day of each week of the school semester.

4.2. Resources and Tools

These are the tools and resources used in the implementation of the application:

- **PhpMyAdmin**: This is a software tool used to handle the database in MySQL. It was used because it is easily accessible and can handle a lot of data
- **Materialise**: This is a CSS framework used to develop the user interface of the application. A very simple template made with Materialise CSS was used in the beginning and was modified later to suit the project.

- **Sublime Text**: this is the text editor used to write the code for this project. It is a cross-platform source code editor with a simple but comprehensive user interface which makes it.
- **XAMPP** (**Apache server**): This open-source web server was used to test out the code written and also gain access to the database in PhpMyAdmin.
- **Phone gap**: This is the tool used to create the mobile app. It transforms PHP, CSS and HTML to mobile apps that can be used on devices running Android, Windows or IOS.
- **SQLite**: SQLite is also a cross-platform library that implements server-less, embeddable, SQL database engines with zero configuration. This was used because there was a need to make the database local to the device the application was installed on and not hosted entirely on a server. The most efficient method found was to use SQLite to create the database.
- **Asynchronous JavaScript and XML (AJAX):** This connects the PHP classes and objects to the HTML and CSS. With AJAX, the application can transmit information to and from the server using synchronous requests. This technique is particularly useful because the application is a Phone Gap application which does not recognise server side code (PHP) unless it is through AJAX.
- **JavaScript Object Notation**: This is a lightweight data-interchange format which is used to parse data from the PHP classes to the JavaScript functions.
- **000Webhost:** This is a free web hosting site that was used to test the application without the local host server.
- **ResponsiveVoice.JS:** This is the instant text-to-speech library which is utilised in this project to play out the words under the vocabulary section of the English lesson.

4.3. Operational Environment

The MTLP application is a Phone Gap application. This makes it multi-platform as it can run on Android, Windows and IOS mobile devices making it easily accessible to users with different mobile devices. The languages used in developing this application are JavaScript, Hypertext Markup Language (HTML), Cascading Stylesheet (CSS), and Hypertext Preprocessor (PHP). Additionally, SQL statements were used to develop a relational database.

4.4. Implementation Approach

To implement the functionalities of the system research had to be done on what method would work best. Since the plan was to develop a Phone Gap application, it was appropriate to implement it using AJAX since Phone Gap does not display PHP. To implement with AJAX, User class, the Lesson Class, and the Assessment Class were created. These classes are shown in Figure 3 below. After which the AJAX functions in PHP were also written. From there the Ajax JavaScript functions were created and linked to the HTML pages.

4.4.1. View Lessons Implementation

This is the implementation of the functional requirement that allows the user to view the lesson in each daily lesson guide. The main class used in this implementation is the lessons class and the class diagram is shown below:

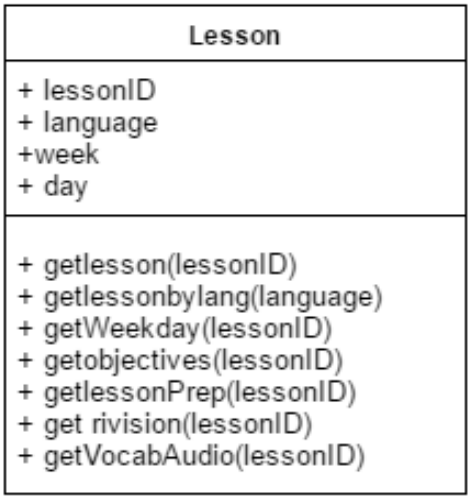

Figure 4.1: Lesson class diagram

In the database, there is a lessons table and each lesson under this table can either be an English lesson or an Akuapem Twi lesson. As stated before, the individual sections of the lesson each have a table to hold their data and the lessons table serves as a foreign key to this table. There is the lessons class which has functions to fetch the lessons by language, the lesson's week and day and the various elements of that lesson such as revision, lesson preparation and vocabulary. There is an AJAX page that calls on to these class functions and returns the results as JSON objects to the HTML page. This is demonstrated in the figure below:

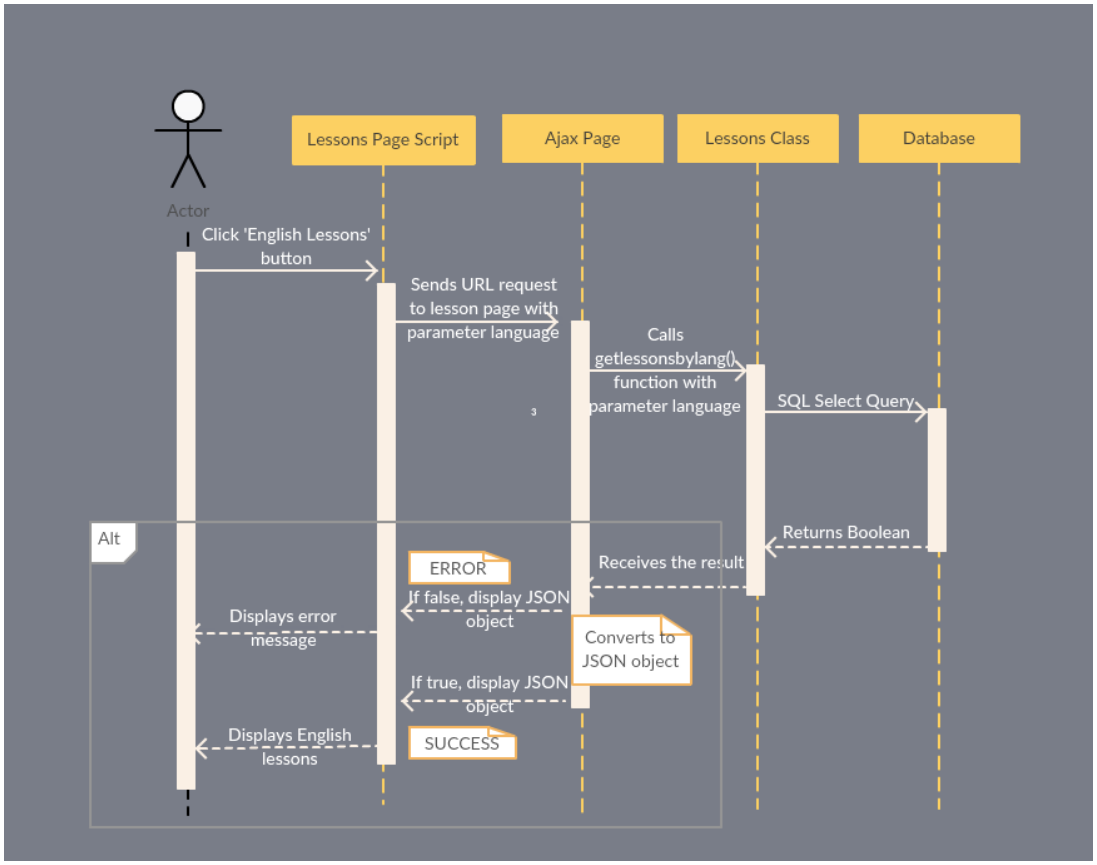

Figure 4.2 View lesson sequence diagram

4.4.2. Timer Implementation

This is the implementation that allows the user to use the timer for the various sections of the lessons. Once the user has selected a lesson the user can click on the ‘start timer’ button which calls the ‘gettime()’ JavaScript function. This function makes an AJAX request to timerajax page and from this page, the lesson class function, ‘gettime’, which takes lesson ID as a parameter, will get the time allocated for that lesson section from the database. This time will be saved in a session storage variable and will be retrieved in the timer HTML page as the time to be counted down by the timer. On this HTML page, there is a stop button that calls the stoptimer function which stops the timer from counting down and a start button that makes the timer continue its countdown.

4.4.3. Assessment Implementation

This implementation meets the functional requirement that says a coach should be able to enter an assessment for a teacher. The main class used in this implementation is the assessment class and the class diagram is shown below:

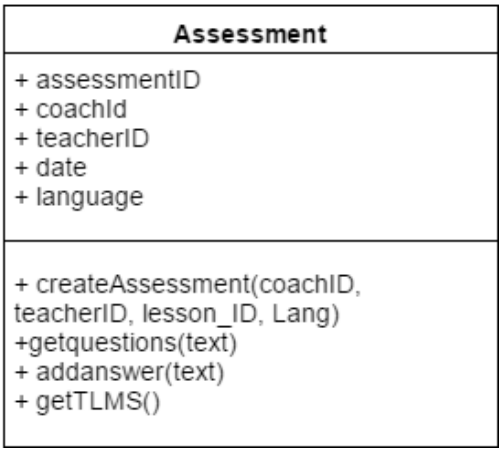

Figure 4.2: Assessment class diagram

In this implementation, there is an HTML page which is designed to take in the coaches and teachers first name and last name as well as the week and day of the lesson for which the teacher is being assessed. When the submit, button is clicked, the names are validated, and if they are found in the database, the 'createAssessment' function is called. This function creates an assessment and sets the teacher ID, coach ID, lesson ID and the language. After the assessment has been created, the assessment form is displayed. The questions in this form are fetched from the database, and once the answers are submitted, they are also stored in the database.

4.4.3. Upload and View TLMs Implementation

This functionality allows the user to select an image from his or her gallery and upload it. Once the upload button has been clicked, the file is validated, and the upload PHP page is called to carry out the upload function to the database. This PHP page has several functions that save the image into the database and return it to the user to show what has

been uploaded. Below is a sequence diagram that shows how this process is carried out within the system:

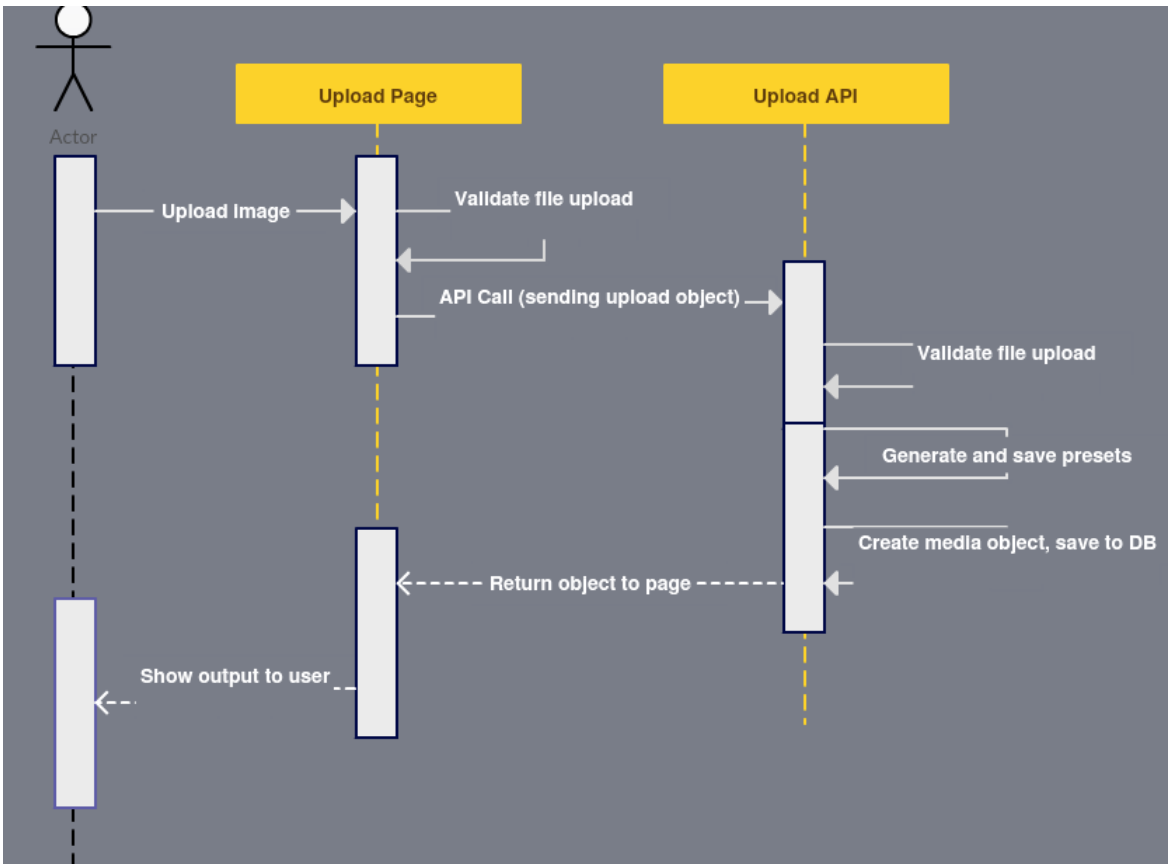

Figure 4.4: View assessment sequence diagram

4.4.5. Login Implementation

The main class used in this implementation is the user's class and the class diagram is shown below:

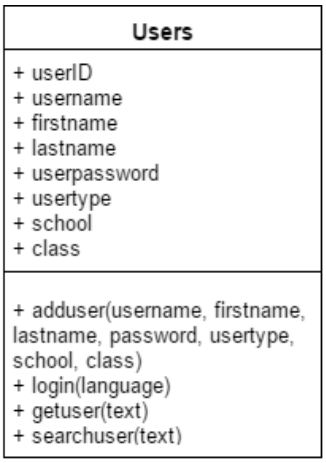

Figure 4.5. User class diagram

This functionality allows the user to get access to the main features of the application. On the login page, the user can enter a username and password and click the login button. The login AJAX function is called, and this validates the user using the user's class. If the user is found, the dashboard of the application will be displayed. However, if the username or password is invalid, there will be an error message telling the user that the username or password is wrong.

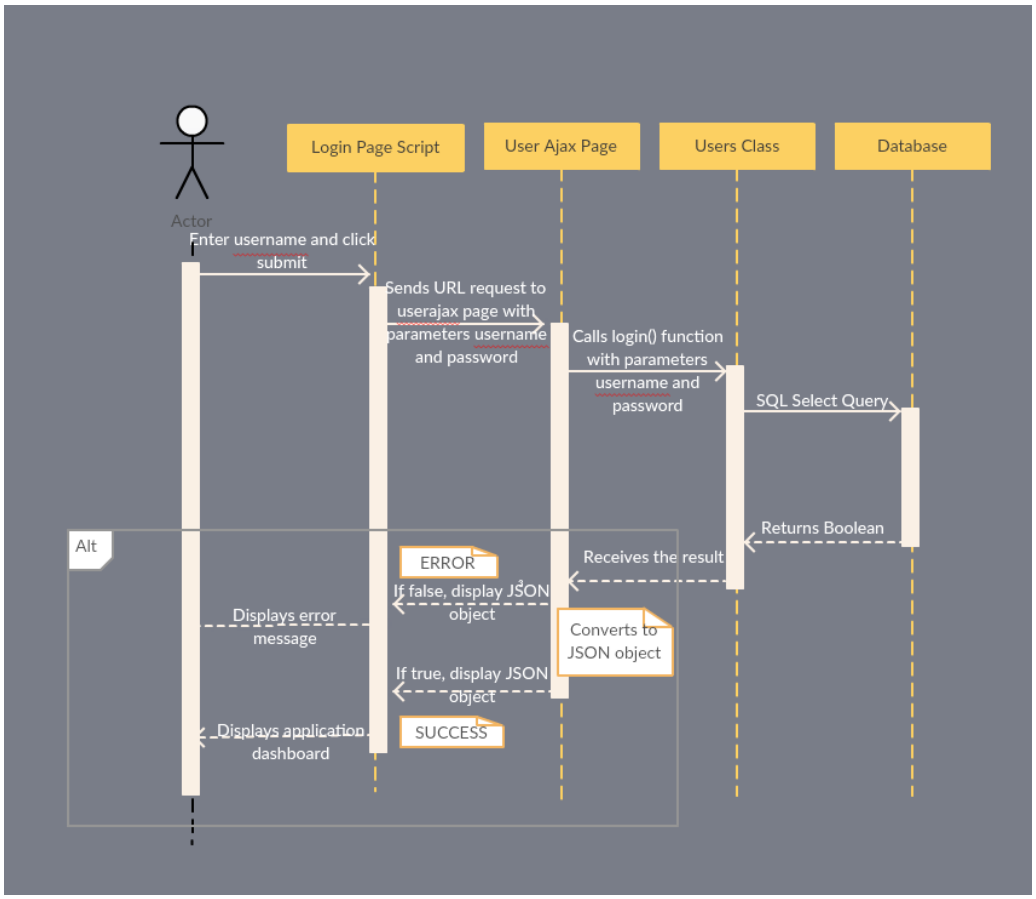

Figure 4.6: Sequence diagram for login

4.5. User Interface Design

The interface of the application is made up of HTML pages which are styled with Materialize CSS. A simple design was chosen to allow the users to understand the functionalities of the application. Below are some screenshots of the various pages of the application:

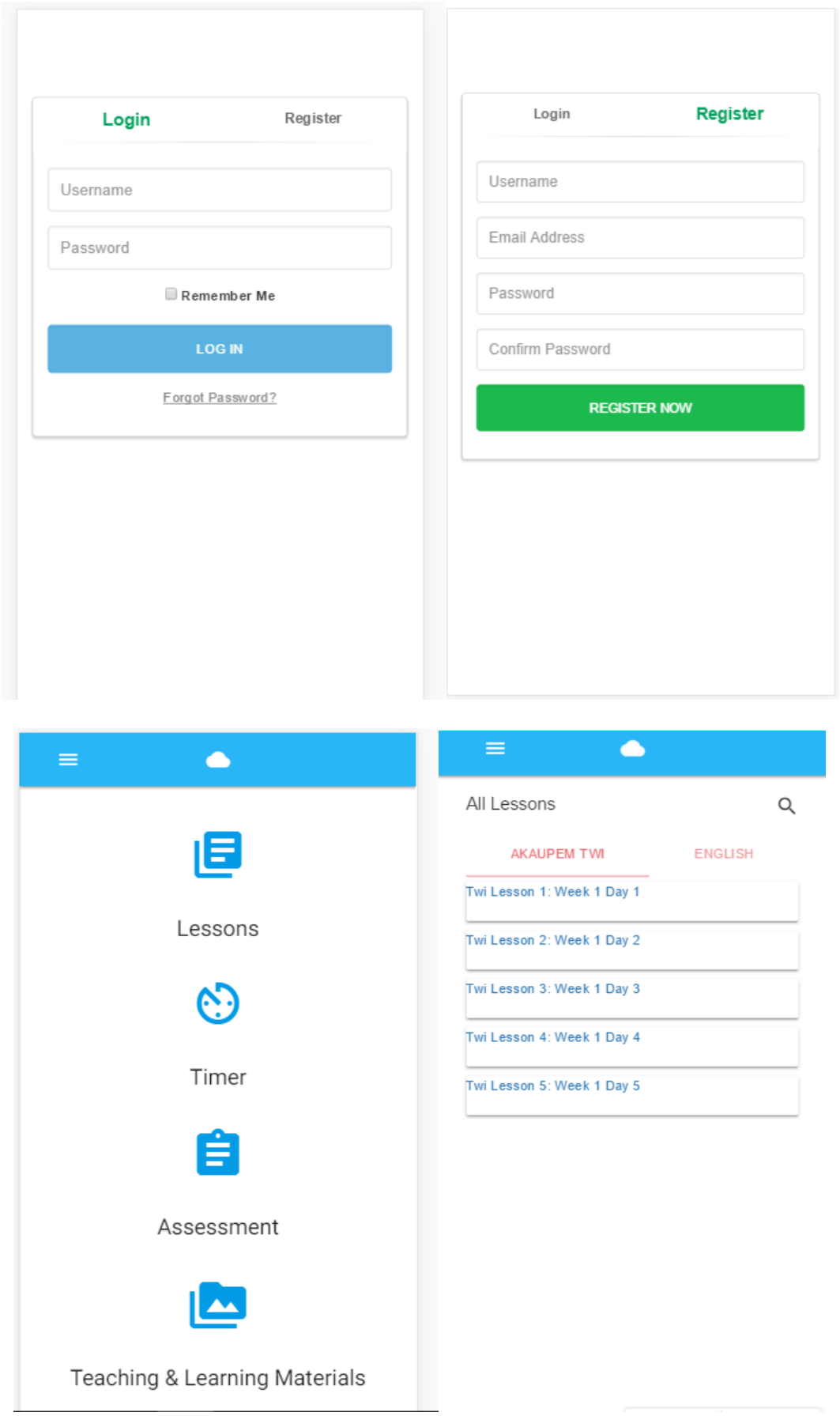

Figure 4.7: User Interface (a)

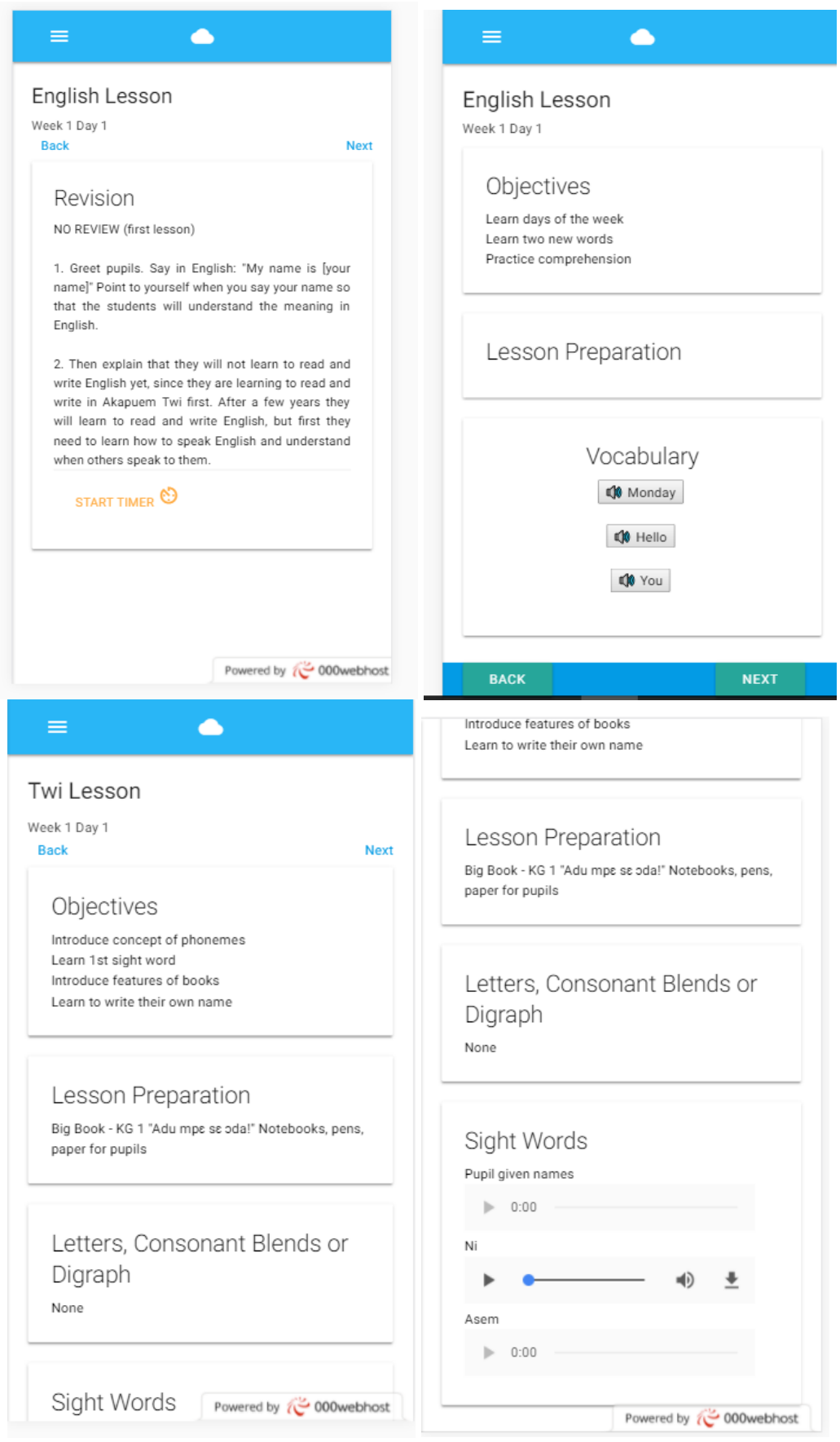

Figure 4.8: User interface (b)

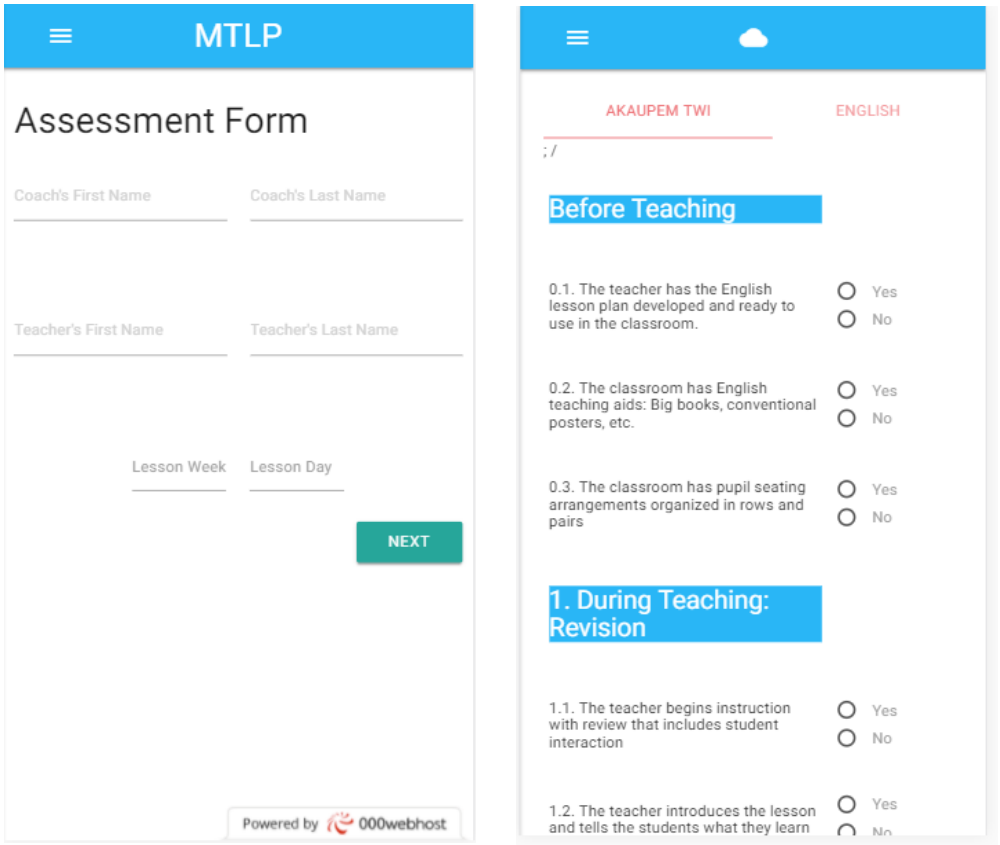

Figure 4.8: User interface (c)

Chapter 5: Testing

After implementing the requirements, the next step was to conduct tests to ensure that the system is functioning as it should. This chapter documents the tests carried out with respect to the functional requirements. The types of test used were Component testing and User Testing.

5.1. Component Testing

5.1.1. User Login:

To ensure that the login works, sample users were created by inserting into the user's table in the database. The application was launched, and in the login page, the new user's details (username and password) were entered and submitted. The result was that was logged into the system and could view the main menu.

Random input was entered and submitted. Since the data could not be found in the database, there was an alert message which read "Wrong Username and Password".

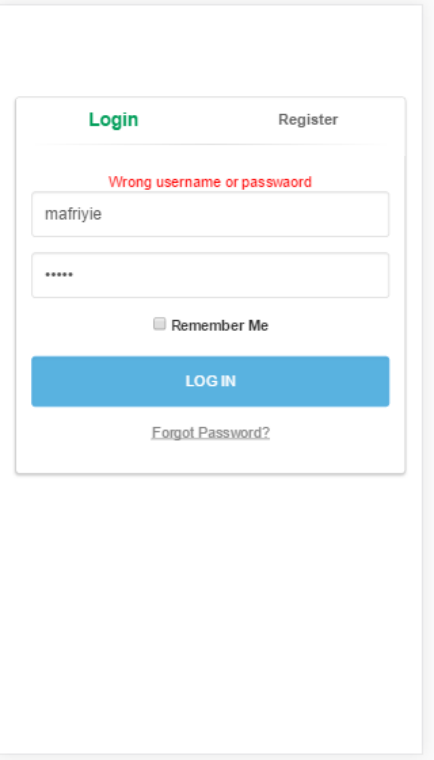

Figure 5.1: Login test

5.1.2. View Lesson:

This test was to find out if the lessons were being displayed correctly. On the Lessons page, an English lesson was selected. The lesson's first page was displayed, and the next button allowed the tester to navigate through the lesson. The different sections of the lesson that was displayed tallied with what was in the English lesson guide. The same process was carried out with an Akuapem Twi Lesson and the lesson displayed was as it was in the book

5.1.3. Audio Playback:

With this test, the main objective was to confirm that an audio is played where it is required to. For instance, in the English lessons, the vocabulary words came with the audio that was provided by the test to speech library. To test it out, the lesson was opened, and the words under vocabulary were clicked (Example: mother). The result was an audio playback of the word which was clicked.

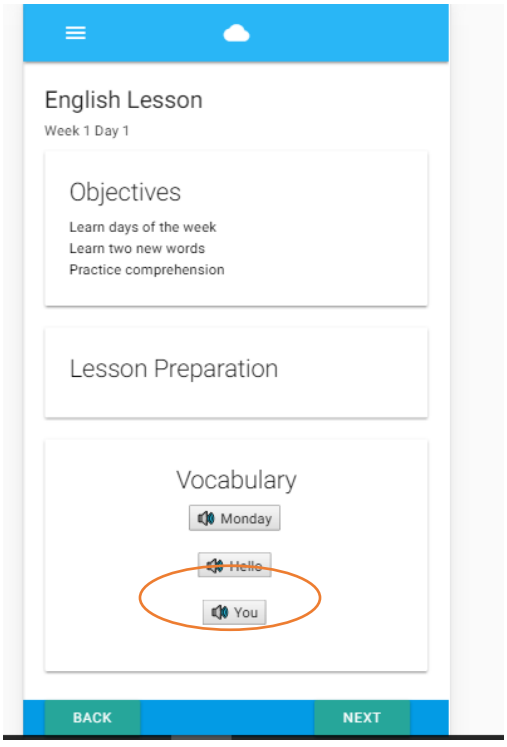

Figure 5.2. Audio test

5.3. Users Testing

The main aim of this test was to examine the application's usability. The outcome of this test was used to modify the application to enhance its usability.

5.3.1. Testing Method

This application was tested on two teachers and a coach from the Anglican school in Akropong. They were given the tablet which had the application installed on it, and their interactions with the system were recorded. They were given 15 minutes to test out the application.

5.3.1. Testing Outcome

From this test, it was observed that the users found it easy to navigate through the application. Each user managed to register and login. They were also able to view the lessons under each of the two languages and start the timer.

Chapter 6: Conclusion and Recommendation

In conclusion, the project has been interesting as it has been challenging. The application developed meets all the functional requirements specified. It displays the lessons under the English and Akuapem Twi languages, has a timer to keep the teachers within the allotted time when teaching, allows coaches to enter assessments for teachers and finally, it lets users upload and view images of teaching and learning materials.

Using a local database also tackles the problem of the unavailability of internet access. However, designing the database was a great hurdle considering the type of data being handled. It was also tedious switching between PHPMyAdmin and SQLite. It is therefore recommended to anyone who intends to develop a similar application to develop a native Android application first since it allows the use of a local database.

There is room to make this project even better. The display of the lesson can be modified to make it more appealing. Also, a template engine can be used to reduce code repetition which tends to waste a lot of time. Additionally, attention should be given to the structure of the database, and this will go a long way to improving the display of the data. The application can be used on only Android and Windows mobile devices at the moment, and as future work, it should be made compatible with iOS devices.

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Appendix

1. Research Interview Questions

Questions for Teachers

1. How do you prepare for class every day?
2. How long does it take you to prepare?
3. Do you face any difficulty when preparing for class? If yes, what are they and how do you think they can be solved?
4. What is your take on the CDs provided as part of the course? How often do you use these CDs?
5. Would you be interested in a tool/application that will help you in your preparation?
6. Which would you prefer; mobile phone or tablet based?
7. Would it be helpful if the application had a feature which pronounces the words and sound for each lesson?
8. Which features would you want to see in the application?
9. How helpful do you think this application will be?

Questions for Coaches

1. How do you help the teachers prepare for their lesson?
2. Do you face any challenges when helping the teachers?
3. Would you be interested in a tool/application that will help you in preparation and coaching?
4. Would like to carry out your coaching review on this tool?
5. How helpful do you think this application will be?